High cell density reactors for ethanol fermentation

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Biofuels and bioethanol, in particular, are an actual topic in EU, due to Directive 2003/30/CE that makes obligatory the replacement of 5.75% of the fuel used in vehicles by biofuels till 2010.
In order to be successful, the fermentation process for bioethanol production has to be competitive with the "classical" process. Among other aspects, the development of high productivity fermentation systems is required and continuous high cell density systems are, undoubtedly, one of the most attractive alternatives to achieve this goal.
Another factor that is determinant in the overall performance of the fermentation system to be used is the design of the bioreactor, being shown that airlift bioreactors are better adapted to these systems, in particular, those where the adhesion forces involved in the immobilization mechanism are weak as is the case of flocculating yeast cell cultures and cell immobilization by adsorption to solid surfaces.
Results describing the development of continuous high cell density airlift reactors for ethanol production will be presented. Aspects such as bioreactor design and performance, hydrodynamics, mass transfer in cell aggregates and their relation with biomass activity will be discussed. Case studies as the bioethanol production from cheese whey using flocculating yeast cell cultures and the continuous primary fermentation of beer using biomass immobilized into spent grains will be presented.